



Title: Introduction to Digital Image Processing in Remote Sensing

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Abstract: Remote sensing provides important information on our planet through digital images acquired from spaceborne or airborne sensors. Hyperspectral images are a specific kind of these datasets: they measure the reflected solar energy from a target on ground in up to hundreds of contiguous and narrow spectral bands of the electromagnetic spectrum. This allows deriving information on the chemical composition of the target, and enables applications on vegetation health analysis, water quality monitoring, recognition of materials and geological features, among many others. In the next years, the first hyperspectral missions capable of monitoring and characterising the Earth's environment on a global scale are expected to be launched. As hyperspectral datasets exhibit a high dimensionality, specific mathematical notions must be applied to successfully employ these images in practical applications. This course gives a brief introduction to remote sensing, and focuses on the mathematical methods used in the processing of remotely sensed data, with a special interest on hyperspectral data cubes. In the specific, the course concentrates on:

- Advantages of analysis in the Fourier domain
- Dimensionality reduction for hyperspectral dataset based on Principal Components Analysis
- Band selection in multiband datasets based on information theoretical measures
- Decomposition of high-dimensional image elements in the spectra of pure elements which compose them (spectral unmixing), achieved through regression with different imposed constraints
- Sparse representation of hyperspectral data

Short Biography: Daniele Cerra received the B.S. and the M.Sc. degree in computer engineering from Roma Tre University in 2003 and 2005 respectively, and the Ph.D. degree in image and signal processing from Télécom Paristech University, Paris, in 2010. Since 2007 he has been with the Department of Photogrammetry and Image Analysis at the German Aerospace Center (DLR), Oberpfaffenhofen, Germany. He has been teaching digital image processing and hyperspectral remote sensing since 2012 as a visiting lecturer in the universities of Osnabrück (Germany), Alcalá (Spain), and Tehran (Iran). He has regularly served as a lecturer in international courses on the same topics at the Carl-Cranz-Gesellschaft (CCG) since 2012, and since 2014 as a trainer at the European Space Agency (ESA), Noordwijk (Netherlands). His research interests include remotely sensed hyperspectral imaging, data compression, and algorithmic information theory.

Course dates	Time	Room
04-05/02/2016	15:00-18:00	MT11-30B
08-09-10-11-12/02/2016	15:00-18:00	MT11-30B